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Human Kinetics
SYSTEMATIC REVIEW

Effectiveness of Mechanical Treatment for Plantar Fasciitis: A Systematic Review

Dorianne Schuitema, Christian Greve, Klaas Postema, Rienk Dekker, and Juha M. Hijmans

Context: Plantar fasciitis is one of the most common foot injuries. Several mechanical treatment options, including shoe inserts, ankle-foot orthoses, tape, and shoes are used to relieve the symptoms of plantar fasciitis. ***Objectives:*** To investigate the effectiveness of mechanical treatment in the management of plantar fasciitis. ***Evidence Acquisition:*** The review was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis statement. A systematic search was performed in PubMed, CINAHL, Embase, and Cochrane up to March 8, 2018. Two independent reviewers screened eligible articles and assessed risk of bias using the Cochrane Collaboration's risk of bias tool. ***Evidence Synthesis:*** A total of 43 articles were included in the study, evaluating 2837 patients. Comparisons were made between no treatment and treatment with insoles, tape, ankle-foot orthoses including night splints and shoes. Tape, ankle-foot orthoses, and shoes were also compared with insoles. Follow-up ranged from 3 to 5 days to 12 months. Cointerventions were present in 26 studies. ***Conclusions:*** Mechanical treatment can be beneficial in relieving symptoms related to plantar fasciitis. Contoured full-length insoles are more effective in relieving symptoms related to plantar fasciitis than heel cups. Combining night splints or rocker shoes with insoles enhances improvement in pain relief and function compared with rocker shoes, night splints, or insoles alone. Taping is an effective short-term treatment. Future studies should aim to improve methodological quality using blinding, allocation concealment, avoid cointerventions, and use biomechanical measures of treatment effects.

Keywords: orthotic devices, shoes, splints, taping

Plantar fasciitis is one of the most common types of foot injuries.[1–3] Approximately 10% of the general population will experience complaints associated with plantar fasciitis once in their life.[4] Patients suffering from plantar fasciitis experience pain along the proximal plantar fascia and around its attachment in the area of the calcaneal tuberosity. Pain aggravates with load, as in walking and running and when first standing after a period of inactivity, such as getting out of bed in the morning.[5]

The exact pathology of plantar fasciitis is still unknown, but a combination of high mechanical stress and repetitive microtrauma is the one leading cause of the pathology.[5] Histological findings suggest the underlying process of plantar fasciitis to be more degenerative rather than inflammatory. Therefore, the term "fasciitis" might be a misnomer and could better be replaced by "fasciosis."[6] Risk factors associated with plantar fasciitis are a high body mass index,[7,8] prolonged weight-bearing, and a limited ankle range of motion.[9] In 45% to 85% of the patients suffering from plantar fasciitis, calcaneal spur is also present.[10]

Several nonsurgical treatment methods are available to relieve symptoms associated with plantar fasciitis. These include stretching, manual therapy, dry needling, shockwave therapy, physical agents (electrotherapy, low-level laser therapy, phonophoresis, and ultrasound), lifestyle counseling, anti-inflammatory injections, and mechanical treatments such as taping, rocker shoes, and (ankle-) foot orthoses ([A]FOs) including night splints.[11]

Mechanical treatments are promising due to the low risk of complications, good accessibility, and high capacity to relieve the mechanical load on the plantar fascia during functional tasks of daily life. The effectiveness of mechanical treatment on plantar fasciitis has previously been investigated.[4,12–18] However, these studies were limited to specific mechanical devices or compared mechanical devices to nonmechanical interventions such as stretching and nonsteroidal anti-inflammatory drugs. An overview of the effectiveness of all mechanical treatment options is still missing. Therefore, the aim of this study is to provide an overview of the effectiveness of all commonly used mechanical treatment options for plantar fasciitis: taping, rocker shoes, and (A)FOs including night splints.

Methods

This review was conducted and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis statement.

Literature Search

A systematic search was performed in 4 electronic databases (MEDLINE, Embase, CINAHL, and Cochrane) using a combination of Medical Subject Headings (MeSH) terms and free-text words. The exact search strategy is described in Appendix. Keywords used were plantar fasciitis, heel spur, calcaneal spur combined via a Boolean AND operator with orthotic devices, shoes, splints, rocker, soles, and tape. The search was performed up to March 26, 2017, and updated on March 8, 2018. Besides the

Schuitema and Greve are with the Center for Human Movement Sciences, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands. Greve, Postema, Dekker, and Hijmans are with the Department of Rehabilitation Medicine, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands. Postema is also with the Roessingh Center for Rehabilitation, Enschede, The Netherlands. Dekker is also with the Center for Sports Medicine, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands. Greve (c.greve@umcg.nl) is corresponding author.

database search, reference lists of all included articles were checked on additional relevant studies.

Included studies were controlled trials, focusing on treating plantar fasciitis with one or more mechanical treatment methods. In case of biomechanical or anatomical outcome measures, no control group was required. Other inclusion criteria were a minimum number of 5 participants, adult aged (≥18 y), and only participants without a disease that could interfere with the symptoms of plantar fasciitis. Only primary research available in full text and written in English, Dutch, or German was included.

After removal of duplicates, 2 authors independently assessed titles, abstracts, and full text against the inclusion criteria. During title selection, articles were selected when at least one of the authors judged the paper to be included. Disagreements between the reviewers during abstract and full-text selection were resolved by discussion between the authors. If still no agreement was reached, a third author would decide.

Risk of Bias

Two authors independently assessed risk of bias using the Cochrane Collaboration's risk of bias tool.[19] Risk of bias addressed in this tool include the following domains: (1) random sequence generation, (2) allocation concealment, (3) blinding of participants, (4) blinding of personnel, (5) blinding of outcome assessment, (6) incomplete outcome data, and (7) selective reporting. Other risks of bias not covered in these domains are (8) similar groups at baseline or corrected for dissimilarities; (9) cointerventions avoided of similar between groups, interventions, or measurements; (10) similar timing of outcome assessment in all groups; and (11) no conflicts of interest. All domains were judged "low risk of bias," "high risk of bias," or "unclear." In the end, studies were considered of "high risk of bias" if one or more domains were judged "high risk." If none of the domains was of "high risk" and one or more domains were "unclear," the study was assessed "unclear." If all domains were of "low risk," the overall judgment was "low risk." Disagreements between the authors were resolved in a consensus meeting. If no consensus could be reached, a third author would decide.

Results

Database Search

The database search yielded 937 articles after removal of 598 duplicates. Title screening resulted in the exclusion of 489 articles, abstract screening resulted in the exclusion of 391 articles, and in the full-text screening, another 18 articles were excluded. From those 18 articles, 2 were excluded because they were not available in full text and 16 because they did not fulfill the other inclusion criteria. Checking references of the 39 remaining articles yielded no other articles. An updated search resulted another 4 articles so in the end, 43 studies were included in the review (Figure 1).

Risk of Bias

Risk of bias assessment (Figure 2) revealed that 33 studies[20–52] had one or more domains assessed as high risk of bias. For 10 studies,[53–62] unclear was highest, and none of the studies scored only low risk of bias (Appendix). Greatest potential sources of high risk were blinding of personnel (37%), blinding of outcome assessors (26%), and cointerventions (30%).

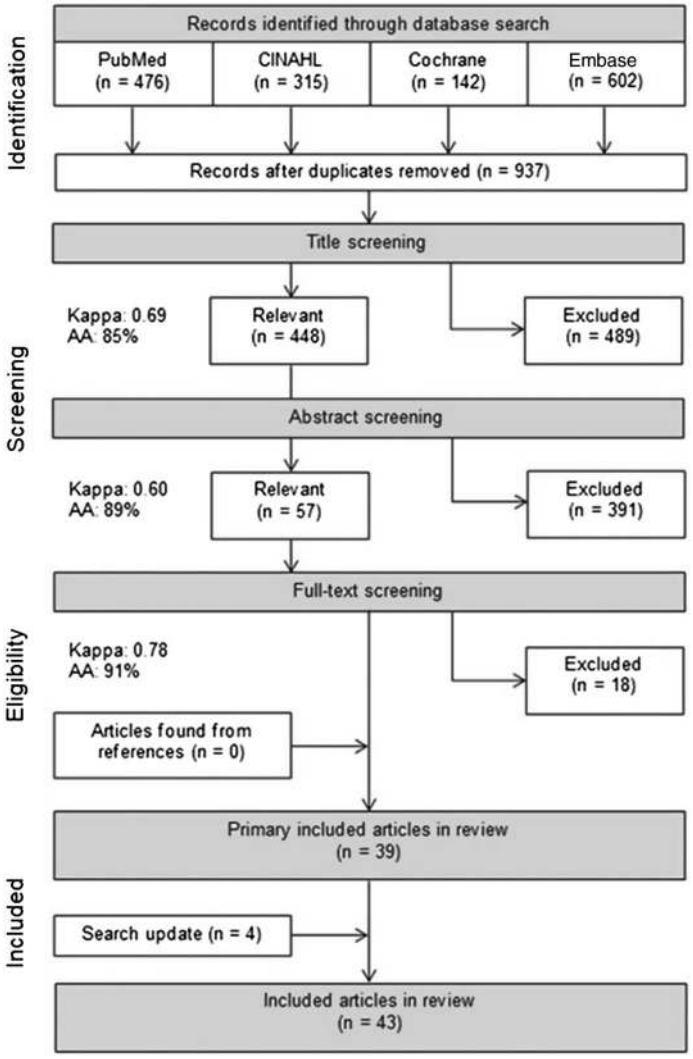

Figure 1 — Flowdiagram of the database search.

Study Selection

The 43 selected studies evaluated interventions in a total of 2837 participants. Study characteristics are shown in Table 1. All participants were diagnosed with plantar fasciitis, except for one study including patients and a control group of healthy participants.[61] In almost all studies, pain scores were used as criteria for patients to participate.[20–23,25–31,33–35,37–39,42–46,48–56,59–62] Four studies also evaluated plantar fascia thickness via radiologic evaluation.[27,44,45,48] Patients who had undergone foot surgery or previous treatment for plantar fasciitis were excluded in 27 out of 43 studies.[21,23,25–31,33–35,38,42,43,46,48,51–56,59–62]

Interventions

All studies evaluated one or more mechanical interventions for plantar fasciitis. The most studied intervention was the insole. Seventeen studies[24,27–30,35,41,43,44,46,48–51,54,59,62] compared insoles to another type of insole, no insole, or to a nonmechanical treatment method. Nine studies focused on taping,[23,34,40,52,55–58,61] 7 studies on night splints,[25,31–33,39,45,47] 2 studies on daytime worn AFOs,[20,38] and 3 studies on shoes.[37,42,51] Comparisons were also

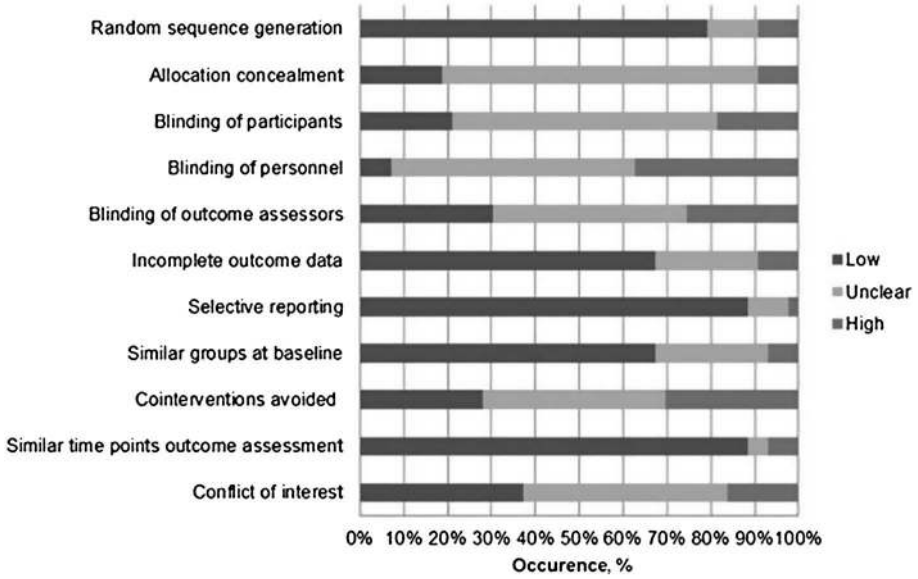

Figure 2 — Risk of bias assessment.

made between different types of mechanical treatment. Five studies were conducted at a single visit.[48,51,54,60,61] Follow-up of the other studies ranged from 3 to 5 days to 12 months.

In some studies, participants used more treatments than just the treatment being examined. These additional treatments were applied to all participants in 20 studies[20,22,23,25,27,30,33,37–41,45–47,53,57–59] and only by part of all participants in 11 studies.[26–29,36,38,41,43,46,50,62]

Effect of Interventions

Outcomes of the included studies are shown in Tables 2 and 3. Based on previous research, minimal clinically important differences were 9 mm for the visual analog scale, 12 for the Foot Function Index (FFI)—pain, 7 for Foot Function Index—disability, 7 for Foot Function Index—total, 14 for the Foot Health Status Questionnaire—pain, and 7 for Foot Health Status Questionnaire—function.[63]

Insoles

The most studied intervention in the included articles was insoles. Comparisons were made between insole and no-insole use, between prefabricated and customized insoles, and between full-length insoles and heel cups.

Of the 25 studies[21,22,24–30,35,36,41–44,46,48–51,53,54,59,60,62] investigating the effect of insoles on plantar fasciitis, 10 studies[24,26,29,30,44,46,48,49,51,54,62] included a control group wearing no insole or a sham orthosis or receiving nonmechanical interventions. Three studies[29,44,51] reported significantly lower pain scores after insole use compared with the control group; one study[62] found significantly lower pain scores in the control group receiving a corticosteroid injection, and 5 other studies[24,26,30,46,49] found no significant differences in pain between insole and control. Improvement in function differed significant between insoles and control in 2 out of 5 studies. One study[24] favored insoles over sham insoles, and another study[62] favored corticosteroid injections over insoles. Biomechanical analysis has been done in 7 studies.[29,44,46,48,51,54,62] Two studies[29,51] found a significantly larger contact area and significantly lower plantar pressure when wearing full-length insoles compared with no insoles, but 2 others found no significant differences.

Prefabricated Versus Customized Insoles. Six studies[24,30,35,43,46,48] focused on differences between prefabricated and customized insoles.

Function was assessed in 4 studies.[24,35,43,46] Two studies[24,35] reported an improvement after both prefabricated and customized insole use, whereas the participants in 2 other studies[43,46] remained at the same function level. None of the included studies found significant differences between both types of insoles. Comparable results were found for pain. Both prefabricated and customized insoles caused a pain decrease in all 4 studies evaluating pain, but again, no significant differences were found between both groups.[24,30,43,46] Significant differences between prefabricated and customized insoles were only found for walking distance, with the customized insole being more effective than the prefabricated insole.

Heel Pads Versus Full-Length Insoles. Effects of full-length insoles and heel pads were evaluated in 4 studies.[27,41,48,54] One study found full-length insoles being more effective in pain reduction than heel cups,[27] but in another study, no significant differences between both interventions were found for pain and function.[41] Biomechanical outcomes were assessed in 2 crossover studies.[48,54] Both studies found significantly lowered heel pressure when wearing a full insole, one study found a significantly larger contact during full-length insole use.[54]

Other Insoles. Two studies[50,59] compared different types of full-length insoles. One assessed satisfaction of a homogenous and heterogeneous thermoplastic orthosis[50] but did not find a significant difference. The other one compared accommodative and functional insoles.[59] Improvements were seen in pain in both groups, but function and quality of life was improved only in the functional insole group. It is unclear whether differences between groups were significant.

Shoes

Shoe adaptations were evaluated in 3 studies.[37,42,51] Fong et al[51] performed a crossover study with a normal shoe, a rocker shoe, and a flat and customized insole. Pain scores were significantly lowered with both rocker shoe conditions and with a normal shoe combined with a customized insole. Rocker shoe combined with customized

Table 1 Study Characteristics

Author (year)	Design	Number (M/F)	Age, mean (SD) [range]	Intervention	Cointervention part of participants (n)	Cointervention all participants	Follow-up
Abd El Salam and Abd Elhafz (2011)[53]	RCT	(1) 15 (12/3) (2) 15 (11/4)	(1) 52.933 (4.542) (2) 52.8 (4.003)	(1) Low-dye taping (2) Prefabricated insole	Unknown	Ultrasound and stretching	3 wk
Al-Bluwi et al (2011)[20]	RCT	(1) 117 (2) 80 (3) 48	(1) 45.16 (5.1) (2) 41.3 (2.6) (3) 43.8 (3.5)	(1) Foot brace (2) Physiotherapy (3) Physiotherapy + local steroid injection	–	NSAIDs	24 wk
Alghadir (2006)[21]	RCT	(1) 30 (11/19) (2) 30 (5/25) (3) 30 (7/23)	(1) 50.23 (11.37) (2) 48.24 (12.73) (3) 49.07 (10.13)	(1) Dorsiflexion night splint (2) Prefabricated insole (3) Dorsiflexion night splint + prefabricated insole	–	–	6 wk
Attard and Singh (2012)[32]	CT	15 (4/11)	51.7 [26–68]	(1) Posterior night splint (2) Anterior night splint	Unknown	Unknown	6 and 12 wk
Baldassin et al (2009)[43]	RCT	142 (35/107) (1) 72 (2) 70	(1) 47.5 (11.5) (2) 47.2 (12.4)	(1) Prefabricated insole (2) Customized insole	Achilles' tendon stretching (40%) and anti-inflammatory treatment or ice (28%)	–	4 and 8 wk
Batt et al (1996)[47]	RCT	32 (11/21) (1) 16 (2) 17	45.7 [20–70]	(1) Posterior night splint (2) No night splint	Unknown	Heel cup; anti-inflammatory medication; gastrocnemius and soleus muscle stretching	4, 10, and 12 wk
Bonanno et al (2004)[54]	CO	36 (24/12)	71 (6.9) [65–92]	(1) Shoe (2) Shoe + silicon heel cup (3) Shoe + soft foam heel pad (4) Shoe + heel lift (5) Shoe + prefabricated insole	Unknown	–	Single visit
Chia et al (2009)[48]	CO	30 (16/14)	M: 53.31 (6.24) F: 32.43 (7.86)	(1) No insole (2) Flat insole (3) Bone spur heel pads (4) Prefabricated foam insole (5) Customized insole	Unknown	–	Single visit
Dimou et al (2004)[49]	RCT	(1) 10 (6/4) (2) 10 (7/3)	(1) 44.1 (2) 40.6	(1) Chiropractic adjustments + Achilles tendon stretching (2) Customized insole	Unknown	Unknown	1, 15, and 29 d and 2 mo
Ferguson et al (1991)[50]	CT	(1) 20 (2) 20	Unknown	(1) Homogenous thermoplastic orthosis (2) Heterogeneous thermoplastic orthosis	Icing (7/10), taping (10/9), stretching (6/3), ultrasound (?/?), medication (2/0), cortisone shots (2/4), heel cups/pads (2/0), new shoes (2/5), physical therapy (4/7), and back adjustments (1/0)	–	3 and 6 mo

(continued)

Table 1 *(continued)*

Author (year)	Design	Number (M/F)	Age, mean (SD) [range]	Intervention	Cointervention part of participants (n)	Cointervention all participants	Follow-up
Fong et al (2012)[51]	CO	15 (3/12)	50.6 (5.3)	(1) Barefoot; (2) Normal shoe + flat insole (3) Normal shoe + customized insole (4) Rocker shoe + flat insole (5) Rocker shoe + customized insole	Unknown	Unknown	Single visit
Hyland et al (2006)[52]	RCT	(1) 10 (8/2) (2) 11 (5/6) (3) 10 (5/5) (4) 10 (3/7)	(1) 34.1 (5.9) (2) 45.5 (12.0) (3) 40.4 (9.4) (4) 37.6 (10.1)	(1) Stretching (2) Calcaneal taping (3) Sham taping (4) No treatment	Unknown	Unknown	1 wk
Kavros (2005)[22]	RCT	50 (41/9) (1) 25 (2) 25	Unknown	(1) Prefabricated insole (2) Aircast AirHeel	Unknown	Achilles-/plantar fascia stretching	12 wk
Landorf et al (2005)[23]	CT	105 (35/70) (1) 65 (2) 35	(1) 47.2 (11.1) (2) 45.6 (10.9)	(1) Low-dye taping (2) No treatment	–	Calf muscle stretches and advise about appropriate footwear	3–5 d
Landorf et al (2006)[24]	RCT	135 (46/89) (1) 45 (2) 44 (3) 46	(1) 48.5 (9.6) (2) 47.3 (11.6) (3) 49.2 (12.0)	(1) Sham insole (2) Prefabricated insole (3) Customized insole	–	–	3 and 12 mo
Lee et al (2012)[25]	CT	28 (2/26) (1) 14 (2) 14	(1) 43 (5) [34–53] (2) 45 (8) [30–54]	(1) Insole (2) Insole + dorsiflexion night splint	–	–	2 and 8 wk
Lynch et al (1998)[26]	RCT	(1) 31 (2) 26 (3) 28	49 [19–81]	(1) Anti-inflammatory injection (2) Prefabricated viscoelastic heel cup (3) Low-dye taping (<4 wk) + customized insole (>4 wk)	(2) Analgesics	–	2, 4, and 6 wk and 3 mo
Malkoc et al (2015)[27]	RCT	(1) 35 (9/29) (2) 40 (17/23)	(1) 45.5 (10.3) [26–63] (2) 50.3 (12.5) [28–70]	(1) Prefabricated insole (2) Prefabricated heel cup	NSAIDs	Stretching	(1) 9.6 (1.8) [8–14] mo (2) 9.9 (1.3) [8–12] mo
Martin et al (2001)[28]	RCT	(1) 85 (24/61) (2) 85 (20/65) (3) 85 (16/69)	(1) 47 (13) (2) 48 (11) (3) 47 (11)	(1) Customized insole (2) Prefabricated insole (3) Posterior night splint	(1) and (2) low-dye taping in first 2 wk	–	2, 6, and 12 wks
Mehta et al (2017)[55]	RCT	(1) 15 (3/12) (2) 15 (5/11)	(1) [20–45]	(1) Kinesiotaping (2) Mulligan taping + physiotherapy	Unknown	Unknown	6 d

(continued)

Table 1 *(continued)*

Author (year)	Design	Number (M/F)	Age, mean (SD) [range]	Intervention	Cointervention part of participants (n)	Cointervention all participants	Follow-up
Oliveira et al (2015)[29]	RCT	(1) 37 (1/36) (2) 37 (7/30)	(1) 48 (10.1) (2) 53 (10.8)	(1) Customized total contact insole (2) Flat insole	NSAIDs	–	45, 90, and 180 d
Ordahan et al (2017)[56]	RCT	(1) 33 (7/26) (2) 37 (9/28)	(1) 47.7 (9.8) (2) 47.8 (12.4)	(1) Kinesio taping (2) Extracorporeal shock-wave therapy	Unknown	Unknown	5 wk
Park et al (2015)[57]	RCT	(1) 15 (2) 15	(1) 38.6 (4.1) (2) 37.4 (4.5)	(1) Low-dye taping (2) No taping	Unknown	TENS; infrared therapy	6 wk
Park et al (2015)[58]	CT	(1) 15 (2) 15	(1) 35.4 (5.03) (2) 35.9 (4.0)	(1) Low-dye taping (2) No taping	Unknown	TENS; infrared therapy	6 wk
Pfeffer et al (1999)[30]	RCT	(1) 39 (11/28) (2) 42 (17/25) (3) 42 (13/29) (4) 43 (13/30) (5) 34 (11/23)	(1) 47 [25–81][a] (2) 49.5 [30–75][a] (3) 48 [26–76][a] (4) 44 [27–69][a] (5) 48.5 [23–69][a]	(1) No insole (2) Silicone heel pad (3) Felt insole (4) Rubber heel cup (5) Customized neutral orthosis	–	Achilles-/plantar fascia stretching	8 wk
Powell et al (1998)[31]	CO	(1) 22 (4/18) (2) 15 (4/11)	48 [22–72] (1) 46.7 (2.8) [22–69] (2) 49.5 (2.5) [33–72]	(1) Posterior night splint (2) No night splint	–	–	30 and 60 d and 6 mo
Probe et al (1999)[33]	RCT	116 (35/81)	46 (11)	(1) Posterior night splint (2) No night splint	Unknown	Ankle dorsiflexion exercises; NSAIDs; shoes with supportive arches and cushioned heels recommended	4, 8, and 12 wk
Radford et al (2006)[34]	RCT	92 (37/55) (1) 46 (2) 46	(1) 51.3 (13.5) (2) 49.2 (13.8)	(1) Low-dye taping (2) Sham taping	–	Sham ultrasound	1 wk
Ring and Otter (2014)[35]	CH	70 (27/43) (1) 35 (2) 35	48 [27–63]	(1) Prefabricated insole (2) Customized insole	–	–	8 wk
Rome et al (2004)[59]	RCT	(1) 22 (2) 26	59.9 (13.5) [33.1–87.9] (1) 58.3 (12.6) (2) 61.2 (14.4)	(1) Accommodative insole (2) Functional insole	Unknown	Stretching	4 and 8 wk
Roos et al (2006)[36]	RCT	43 (9/34) (1) 13 (2) 15 (3) 15	46 [22–63]	(1) Customized insole (2) Anterior night splint (3) Customized insole + anterior night splint	(1) Homeopathy (1) (2) Insoles (2) (3) Anti-inflammatory gel (1)	–	6, 12, 26, and 52 wk
Ryan et al (2009)[37]	RCT	(1) 9 (2) 12	(1) 42 (7) (2) 38 (12)	(1) Nike Free 5.0 (2) Conventional running shoe	–	Stretching/balance exercises	6 and 12 wk and 6 mos

(continued)

Table 1 *(continued)*

Author (year)	Design	Number (M/F)	Age, mean (SD) [range]	Intervention	Cointervention part of participants (n)	Cointervention all participants	Follow-up
Sharma and Loudon (2010)[38]	RCT	(1) 6 (0/6) (2) 8 (1/7)	(1) 44.2 (11.3) [26–58] (2) 40.3 (7.0) [34–50]	(1) Posterior AFO (2) Stretching + plantar fascia massage	Anti-inflammatory medications; Previous worn orthotics	Foot arch support insoles	4, 8, and 12 wk
Sheridan et al (2010)[39]	RCT	60 (14/46) (1) 30 (2) 30	49.5 (18.2)	(1) Customized dorsiflexion night splint (2) No night splint	Unknown	NSAIDs, orthotic devices, and corticosteroid injections	12 wk
Tsai et al (2010)[40]	RCT	52 (19/33) (1) 26 (2) 26	(1) 52.67 (28.75) (2) 30.50 (13.14)	(1) Kinesiotaping (2) No kinesiotaping	–	Ultrasound; TENS,	2 wk
Turlik et al (1999)[41]	RCT	(1) 30 (7/23) (2) 25 (11/14)	(1) 46 (2) 44	(1) Prefabricated heel cup (2) Customized insole	NSAIDs (18/5); local steroid injections (7/8); ultrasound (2/0);	Active stretches	3 mo
Van Lunen (2011)[60]	CO	17 (5/12)	M: 34.8 (15.3) F: 36.8 (16.5)	(1) Prefabricated insole (2) Low-dye taping	Unknown	Unknown	Single visit
Van Tonder et al (2018)[61]	RCT	(A) 10 (3/7) (B) 10 (4/6)	(A) 58 (11) (B) 59 (11)	(1A) Low-dye taping – Patient (1B) Low-dye taping – Control (2A) Sham taping – Patient (2B) Sham taping – Control (3A) No taping – Patient (3B) No taping – Control	Unknown	Unknown	Single visit
Vicenzino et al (2015)[42]	RCT	150 (48/102) (1) 49 (2) 50 (3) 51	(1) 52 (11) (2) 50 (12) (3) 50 (13)	(1) Contoured sandal (2) Flat flip-flop (3) Prefabricated insole	Unknown	Unknown	4 and 12 wks
Walther et al (2013)[44]	RCT	(1) 10 (2/8) (2) 10 (3/7) (3) 10 (4/6)	(1) 51.6 (12.5) (2) 53.8 (13.2) (3) 53.9 (14.9)	(1) Prefabricated nonsupportive insole (2) Prefabricated soft supportive foam insole (3) Prefabricated foam covered rigid self-supporting insole	–	–	3 wks
Wheeler (2017)[45]	RCT	(1) 20 (5/15) (2) 20 (7/13)	(1) 53.4 (8.9) (2) 50.9 (11.7)	(1) Posterior night splint (2) No night splint	Unknown	Stretching and balance training exercises	6 wk and 3 mo
Wrobel et al (2015)[46]	RCT	(1) 26 (2) 26 (3) 25	49.61 (12.07) [23–75]	(1) Sham insole (2) Customized insole (3) Prefabricated insole	Stretching and ice massage	Standardized athletic shoes	1 and 3 mo
Yucel et al (2013)[62]	RCT	(1) 20 (4/16) (2) 20 (4/16)	(1) 45.6 (9.3) (2) 47.4 (7.9)	(1) Corticosteroid injection (2) Prefabricated insole	(2) Analgesics	–	1 mo

Abbreviations: AFO, ankle-foot orthosis; CH, cohort study; CO, crossover study; CT, controlled trial; NSAIDs, nonsteroidal anti-inflammatory drugs; RCT, randomized controlled trial; TENS, transcutaneous electrical nerve stimulation.

[a]Median [range].

Table 2 Subjective Study Outcomes

Author (year)	Intervention	Outcome variables	Function	Pain	QoL	Satisfaction	Tenderness	Weeks to cure	Significant between-group differences
Abd El Salam and Abd Elhafz (2011)[53]	(1) Low-dye taping (2) Prefabricated insole	Pain (VAS) Function (MFPDQ)	+ +	+[c] +[c]					Function: 2 < 1 Pain: 2 < 1
Al-Bluwi et al (2011)[20]	(1) Foot brace (2) Physiotherapy (3) Physiotherapy + local steroid injection	Pain (VAS, SFMPQ)		+[a,c] +[a] +[a]					Pain: 1 < 3 < 2
Alghadir (2006)[21]	(1) Dorsiflexion night splint (2) Prefabricated insole (3) Dorsiflexion night splint + prefabricated insole	Pain (FFI pain score); function (FFI disability score)	+[a] +[a] +[a,c]	+[a,c] +[a] +[a,c]			+[a] −[a] +[a]		Function: 3 < 1 & 2 Pain: 3 < 1 & 2 Tenderness: 3 > 1 & 2[b]
Attard and Singh (2012)[32]	(1) Posterior night splint (2) Anterior night splint	Pain (VAS); patient satisfaction		+[c] +[c]		22% satisfied 78% satisfied			Pain: 2 < 1
Baldassin et al (2009)[43]	(1) Prefabricated insole (2) Customized insole	Pain (FFI pain score); function (FFI total score)	0 0	+[c] +[c]					Function: ns Pain: ns
Batt et al (1996)[47]	(1) Posterior night splint (2) No night splint	Weeks to cure						+ r	Weeks to cure: 1 < 2
Dimou et al (2004)[49]	(1) Chiropractic adjustments + Achilles tendon stretching (2) Customized insole	Pain (NRS); function (effect on 3 activities)	+ +	+ +			+ +		Function: ns Pain: ns Tenderness: ns
Ferguson et al (1991)[50]	(1) Homogenous thermoplastic orthosis (2) Heterogeneous thermoplastic orthosis	Patient satisfaction (perception of effectiveness)				+[a] +[a]			Satisfaction: ns
Fong et al (2012)[51]	(1) Barefoot (2) Normal shoe + flat insole (3) Normal shoe + customized insole (4) Rocker shoe + flat insole (5) Rocker shoe + customized insole	Pain (VAS)		r 0[c] +[c] +[c] +[c]					Pain: 5 < 3 & 4 < 2 < 1
Hyland et al (2006)[52]	(1) Stretching (2) Calcaneal taping (3) Sham taping (4) No treatment	Pain (VAS) and function (PSFS)	0 0 0 −	+[c] +[c] + 0					Function: ns Pain: 2 < 1 < 4 and 2 < 3
Kavros (2005)[22]	(1) Prefabricated insole (2) Aircast AirHeel	Pain (FFI pain score)		+[c] +[c]					Pain: ns

(continued)

Table 2 *(continued)*

Author (year)	Intervention	Outcome variables	Function	Pain	QoL	Satisfaction	Tenderness	Weeks to cure	Significant between-group differences
Landorf et al (2005)[23]	(1) Low-dye taping (2) No treatment	Pain (VAS); patient satisfaction (perception of effectiveness)		+[a,c] −[a]		+[a] +[a]			Pain: 1 < 2 Satisfaction: 1 > 2[b]
Landorf et al (2005)[24]	(1) Sham insole (2) Prefabricated insole (3) Customized insole	Pain (FHSQ pain score); function (FHSQ function score)	+[c] +[c] +[c]	+[c] +[c] +[c]					Function: 2 & 3 > 1[b] Pain: ns
Lee et al (2006)[25]	(1) Insole (2) Insole + dorsiflexion night splint	Pain (FFI pain score); function (FFI total score); patient satisfaction (comfort)	0 +[c]	0 +[c]		No discomfort in both groups			Function: 2 < 1 Pain: 2 < 1
Lynch et al (1998)[26]	(1) Anti-inflammatory injection (2) Prefabricated viscoelastic heel cup (3) Low-dye taping (<4 wk) + customized insole (>4 wk)	Pain (VAS)		+[c] +[c] +[c]					Pain: 3 < 2
Malkoc et al (2015)[27]	(1) Prefabricated insole (2) Prefabricated heel cup	Pain (VAS); function (FAAM daily activity score, sporting activity score)	+ +	+[c] +[c]					Function: ns Pain: ns
Martin et al (2001)[28]	(1) Customized insole (2) Prefabricated insole (3) Posterior night splint	Pain (VAS)		+[a,c] +[a,c] +[a,c]					Pain: ns
Mehta et al (2017)[55]	(1) Kinesio taping (2) Mulligan taping + physiotherapy	Pain (VAS), Function (FFI)	+ +[c]	+[c] +[c]					Function: 2 < 1[a] Pain: 2 < 1[a]
Oliveira et al (2015)[29]	(1) Customized total contact insole (2) Flat insole	Pain (VAS); function (FFI, FHSQ); QoL (SF-36); patient satisfaction (LS)	+[c] +[c]	+[c] +[c]	+ +	+ +			Function: ns Pain: 1 < 2 QoL: ns Satisfaction: ns
Ordahan et al (2017)[56]	(1) Kinesio taping (2) Extracorporeal shockwave therapy	Pain (VAS, HTI); function (FAOS ADL); QoL (FAOS QoL)	+ +	+[c] +[c]	+ +				Function: ns Pain: ns QoL: ns
Park et al (2015)[58]	(1) Low-dye taping (2) No taping	Pain (VAS)		+[c] +[c]					Pain: 1 < 2

(continued)

Table 2 *(continued)*

Author (year)	Intervention	Outcome variables	Function	Pain	QoL	Satisfaction	Tenderness	Weeks to cure	Significant between-group differences
Pfeffer et al (1999)[30]	(1) No insole (2) Silicone heel pad (3) Felt insole (4) Rubber heel cup (5) Customized neutral orthosis	Pain (FFI pain score)		+[c] +[c] +[c] +[c] +[c]					Pain: ns
Powell et al (1998)[31]	(1) Posterior night splint (2) No night splint	Pain (scale 1–10); function (AOFAS, MCSS); patient satisfaction	+ 0	+[c] 0		73% satisfied; 27% dissatisfied			Function: 1 > 2[b] Pain: 1 < 2
Probe et al (1999)[33]	(1) Posterior night splint (2) No night splint	Pain (scale 0–4); function (SF-36)	+ +	+ +					Function: ns Pain: ns
Radford et al. (2006)[34]	(1) Low-dye taping (2) Sham taping	Pain (VAS); function (FHSQ foot function score)	+[c] +[c]	+[c] +[c]					Function: ns Pain: 1 < 2
Ring and Otter (2014)[35]	(1) Prefabricated insole (2) Customized insole	Function (MFPDQ); patient satisfaction	+ +			+ +			Function: ns Satisfaction: ns
Rome et al (2004)[59]	(1) Accommodative insole (2) Functional insole	Pain (FHSQ foot pain score); function: FHSQ foot function score); QoL (EQ5D)	0 +[c]	+[c] +[c]	0 +				Function:? Pain:? QoL:?
Roos et al (2006)[36]	(1) Customized insole (2) Anterior night splint (3) Customized insole + anterior night splint	Pain (FAOS pain score); function (FAOS ADL score); QoL (FAOS QoL score)	+ + +	+ + +	+ + +				Function: ns Pain: 1 & 3 > 2[b] QoL: ns
Ryan et al (2009)[37]	(1) Nike Free 5.0 (2) Conventional running shoe	Pain (VAS)		+[c] +[c]					Pain: ns
Sharma and Loudon (2010)[38]	(1) Posterior AFO (2) Stretching + plantar fascia massage	Pain (FFI pain scores); function (AOFAS)	+ +	+ +					Function: ns Pain: ns
Sheridan et al (2010)[39]	(1) Customized dorsiflexion night splint (2) No night splint	Pain (PFPDS)		+[a] 0[a]					Pain: 1 < 2
Tsai et al (2010)[40]	(1) Kinesio taping (2) No kinesio taping	Pain (MPQ)		+ +					Pain: 1 < 2
Turlik et al (1999)[41]	(1) Prefabricated heel cup (2) Customized insole	Pain (scale 0–5)		? ?		? ?			Pain: 2 < 1 Satisfaction: 2 < 1
Van Lunen (2011)[60]	(1) Prefabricated insole (2) Low-dye taping	Pain (VAS)		+[c] +[c]					Pain: ns

(continued)

Table 2 *(continued)*

Author (year)	Intervention	Outcome variables	Function	Pain	QoL	Satisfaction	Tenderness	Weeks to cure	Significant between-group differences
Van Tonder et al (2018)[61]	(1A) Low-dye taping (patient) (1B) Low-dye taping (control) (2A) Sham taping (patient) (2B) Sham taping (control) (3A) No taping (patient) (3B) No taping (control)	Pain (NRS 0–10)		+ ? 0 ? r ?					Pain: 1A < 2A & 3A
Vicenzino et al (2015)[42]	(1) Contoured sandal (2) Flat flip-flop (3) Prefabricated insole	Pain (NRS 0–10); function (LEFS)	0 0 0	+[a] +[a] +[a]					Function: ns Pain: 1 < 2
Walther et al (2013)[44]	(1) Prefabricated nonsupportive insole (2) Prefabricated soft supportive foam insole (3) Prefabricated foam covered rigid self-supporting insole	Pain (VAS); patient satisfaction (comfort VAS)		0 +[c] +[c]		Single measurement			Pain: 2 < 1, 3 < 2 & 1 Satisfaction: 2 & 3 > 1[b]
Wheeler (2017)[45]	(1) Posterior night splint (2) No night splint	Pain (scale 0–10), Function (FFI-R total, MOXFQ)	+[c] +[c]	+[c] +[c]					Function: ns Pain: ns
Wrobel et al (2015)[46]	(1) Sham insole (2) Customized insole (3) Prefabricated insole	Pain (VAS, FFI-R pain score); function (FFI-R, SF-36)	0 0 0	+[c] +[c] +[c]					Function: ns Pain: ns
Yucel et al (2013)[62]	(1) Corticosteroid injection (2) Prefabricated insole	Pain (VAS); QoL (FAOS QoL score)	+ +	+[c] +[c]	+ +				Function: 1 > 2[b] Pain: 1 > 2[b] QoL: ns

Abbreviations: –, negative effect;?, effect unclear; +, positive effect; 0, no effect; ADL, activities of daily living; AFO, ankle-foot orthosis; AOFAS, American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Scale; EQ5D, EuroQol 5D; FAAM, foot and ankle ability measure; FAOS, foot and ankle outcome score; FFI, Foot Function Index; FFI-R, Foot Function Index-revised; FHSQ, Foot Health Status Questionnaire; HTI, heel tenderness index; LEFS, Lower Extremity Function Scale; LS, Likert scale; MCSS, Mayo Clinical Scoring System; MFPDQ, Manchester Foot Pain and Disability Questionnaire; MOXFQ, Manchester-Oxford Foot Questionnaire; Numerical Rating Scale; MPQ, McGill Pain Questionnaire; NRS, Numerical Rating Scale; ns, not significant; PFPDS, Plantar Fasciopathy Pain/Disability Scale; PSFS, Patient-Specific Function Scale; QoL, Quality of Life; r, reference score; SF-36, 36-Item Short Form Health Survey; SFMPQ, Short-Form McGill Pain Questionnaire; VAS, visual analog scale.
[a]Significance unknown. [b]High scores indicate better performance. [c]Clinically relevant effect.

Table 3 Objective Study Outcomes

Author (year)	Intervention	Outcome variables	Contact area	Pressure	Maximum force	Weight distribution	Walking distance	Gait	ROM	Stability	Plantar fascia thickness	Significant between-group differences
Alghadir (2006)[21]	(1) Dorsiflexion night splint (2) Prefabricated insole (3) Dorsiflexion night splint + prefabricated insole	ROM (ankle dorsiflexion) and tenderness (pressure–pain threshold)							+[a] −[a] +[a]			ROM: 3 > 1 & 2[b]
Bonanno et al (2004)[54]	(1) Shoe (2) Shoe + silicon heel cup (3) Shoe + soft foam heel pad (4) Shoe + heel lift (5) Shoe + prefabricated insole	Contact area (contact area heel), force (maximum force heel), and pressure (peak pressure heel)	r − − 0 +	r + + 0 +	r 0 0 − +							Contact area: 5 > 1 & 2 & 3 & 4[b] Peak pressure: 5 < 1 & 2 & 3 & 4 Force heel: 5 < 2 & 3 and 2 & 3 < 4[a]
Chia et al (2009)[48]	(1) No insole (2) Flat insole (3) Bone spur heel pads (4) Prefabricated foam insole (5) Customized insole	Contact area (total contact area), force (total/rearfoot plantar force), pressure (total/rearfoot peak pressure)	r + − + +	r + − + +	r 0 0 0 0							Contact area: ns Pressure: 5 < 4 < 2 < 1 < 3[a] Force: ns
Fong et al (2012)[51]	(1) Barefoot (2) Normal shoe + flat insole (3) Normal shoe + customized insole (4) Rocker shoe + flat insole (5) Rocker shoe + customized insole	Pressure (medial/lateral heel)		Single measurement								Pressure: 5 < [d]3 < 4 < [d]2
Kavros (2005)[22]	(1) Prefabricated insole (2) Aircast AirHeel	Contact area (total contact area) and force (force at midstance)	+ +		0 +							Contact area: ns Force: 2 < 1
Oliveira et al (2015)[29]	(1) Customized total contact insole (2) Flat insole	Contact area (surface contact static/dynamic), pressure (static/dynamic), walking distance (6MWT), and weight distribution	0 0	0 0		0 0	+[a] +[a]					Contact area: ns Pressure: ns Weight distribution: ns Walking distance: 1 > 2[b]
Park et al (2015)[57]	(1) Low-dye taping (2) No taping	Weight distribution (posterior/anterior weight distribution)				+ +						Weight distribution: 1 > 2[b]

(continued)

Table 3 *(continued)*

Author (year)	Intervention	Outcome variables	Contact area	Pressure	Maximum force	Weight distribution	Walking distance	Gait	ROM	Stability	Plantar fascia thickness	Significant between-group differences
Park et al (2015)[58]	(1) Low-dye taping (2) No taping	Stability (TAOCOG)								+ 0		Stability: 1 > 2[b]
Sharma and Loudon (2010)[38]	(1) Posterior AFO (2) Stretching + plantar fascia massage	ROM (great toe)							0 0			ROM: ns
Tsai et al (2010)[40]	(1) Kinesiotaping (2) No kinesiotaping	Plantar fascia thickness									+ 0	Plantar fascia thickness: 1 < 2
Van Lunen (2011)[60]	(1) Prefabricated insole (2) Low-dye taping	Pressure (rearfoot mean/peak plantar pressure walking)		ppp: 0 0 mpp: 0 +								Pressure: 2 < 1
Walther et al (2013)[44]	(1) Prefabricated nonsupportive insole (2) Prefabricated soft supportive foam insole (3) Prefabricated foam covered rigid self-supporting insole	Walking distance					0 0 0					Walking distance: ns
Wheeler (2017)[45]	(1) Posterior night splint (2) No night splint	Plantar fascia thickness									0 +	Plantar fascia thickness: ns
Wrobel et al (2015)[46]	(3) Sham insole (4) Customized insole (5) Prefabricated insole	Stability (ankle/hip/COM sway), gait, and walking distance					+ + +	0 0 0		0 + 0		Walking distance: 2 > 1 & 3[b] Gait: ns Stability: ns
Yucel et al (2013)[62]	(1) Corticosteroid injection (2) Prefabricated insole	Plantar fascia thickness									+ +	Plantar fascia thickness: 1 < 2

Abbreviations: –, negative effect; +, positive effect; 0, no effect; 6MWT, 6-minute walk test; AFO, ankle-foot orthosis; COM, center of mass; mpp, mean plantar pressure; ns, not significant; ppp, peak plantar pressure; r, reference score; ROM, range of motion; TAOCOG, transfer area of the center of gravity.
[a]Significance unknown. [b]High scores indicate better performance. [c]Clinically relevant effect. [d]Only on medial heel (not lateral).

insole was best in relieving pressure followed by normal shoe combined with customized insole and rocker shoe combined with flat insole. No improvement in function was observed for flat flip-flops, prefabricated insoles and sandals having contours such as the insole, but contoured sandals were more effective in pain reduction than flat flip-flops.[42]

Ankle-Foot Orthoses

Three studies[20,22,38] examined the effect of daytime worn AFOs on plantar fasciitis. Two compared[20,38] AFOs with nonmechanical treatments. No significant differences in function were found.[38] One study[20] did find a significant differences in pain, with the AFO being more effective, but another study[38] did not.

One study[22] compared an AFO with a prefabricated insole. No significant differences in pain and contact area were found. Plantar force was significantly lowered in the AFO group.

Night Splints

Ankle-foot orthoses worn at night were evaluated in 10 articles.[21,25,28,31–33,36,39,45,47] Five[31,33,39,45,47] studied patients with and without a night splint. Four[31,33,39,45] of them assessed pain and 2 found significantly lower pain scores after night splint use.[31,39] Function was improved after night splint use in 1 out of 2 studies.[31] The other one[33] did not find a significant difference with or without night splints. A distinction was made between anterior and posterior night splints in one study. Participants wearing the anterior night splint were more satisfied compared with posterior night splint users.[32]

Night Splints Versus Insoles

Four studies[21,25,28,36] compared night splints with insoles. There were no significant differences in pain,[21,28] function,[21,36] quality of life,[36] ankle dorsiflexion, and heel tenderness[21] between night splint or insole use, but combining night splints and insoles did lead to improvement in pain, function,[21,25] ankle dorsiflexion, and heel tenderness.[21] One study reported a different result and found significantly lower pain scores after insole use compared with night splint and night splint + insole. Night splint and night splint + insole did not differ significantly.[36]

Taping

A total of 12 studies[23,26,34,40,52,53,55–58,60,61] investigated the effect of taping on plantar fasciitis. Eight studies[23,26,34,53,57,58,60,61] used low-dye tape. Other taping techniques used were kinesiotaping,[40,55,56] calcaneal taping,[52] and Mulligan taping.[55]

Seven studies[23,34,40,52,57,58,61] compared taping with no treatment or sham taping. Of these studies, 6 studies[23,40,52,58,61,64] had pain as an outcome measure, and they all reported a significant decrease in pain in the taping group. Four studies[34,40,52,58] also reported a significant pain reduction in the control group, but all favored taping over no taping or sham taping. Function did not differ significantly between taping and no taping,[34,52] but taping was most effective regarding to weight distribution,[57] stability,[58] and plantar fascia thickness.[40]

Taping Versus Insoles

Three studies[26,53,60] compared low-dye taping to insoles. All observed a decrease in pain in both taping and insole groups; 2 studies[26,53] found a significant difference between both interventions, with the insole being more effective in reducing pain than tape. Insoles were also found to be more effective in improving function,[53] whereas tape led to significantly lower mean plantar pressure.[60]

Discussion

The aim of this study was to systematically review the effects of insoles, AFOs, shoes, and tape as treatment for plantar fasciitis. In total, 43 studies were included, evaluating 2837 patients. Treating plantar fasciitis mechanically seems to be beneficial in relieving symptoms related to plantar fasciitis. None of the included studies reported a negative effect of mechanical treatment; all were reporting a positive or no effect.

Of all included studies, the most investigated treatment was insoles. Insoles in different shapes and materials are used to treat plantar fasciitis. Insoles covering the whole foot have a larger area of contact between the insole and the foot compared with heel cups. A larger contact area improves pressure distribution under the foot and therefore minimizes peak pressures at the insertion of the plantar fascia.[48,54] Moreover, insoles having contours support the longitudinal arch, which is associated with less plantar fascia strain.[65] However, despite the biomechanical differences between full-length insoles and heel cups, only one[41] out of 3 studies reported a significantly larger pain decrease after full-length insole use compared with heel cups. The other 2 studies[27,30] did not report significant differences between both shoe inserts. Furthermore, the effectiveness of prefabricated insoles on pain relief was compared with customized insoles. Because customized insoles are individually adapted to the anatomy of a person's foot, we expected favorable effects of customized insoles. However, pain and function scores were comparable between prefabricated and customized insoles.[24,30,35,43,46]

As an alternative to insoles, shoe adaptations might be used to relieve symptoms associated with plantar fasciitis. A commonly used adaptation is a rocker-soled shoe with a stiff insole and proximal apex position. A more proximal apex position facilitates early heelrise and therefore minimizes external plantar flexion moments and plantar forefoot pressure. Lower plantar flexion moments require less pulling forces of the Achilles tendon, which leads to a smaller plantar fascia strain during gait.[66–69] A proximal apex position in combination with a stiff insole further minimizes plantar fascia strain by preventing excessive bending of the metatarsophalangeal joints (MTP joints).[70–72] In line with this proposed biomechanical effects of rocker shoes, lowered pain scores were found after the use of rocker shoes. Interestingly, prescribing rocker shoes combined with contoured insoles led to an even larger pain reduction.[51] According to the authors, this was due to the pressure distributing properties of the insole. However, the contoured insoles were stiffer than the flat insoles, so the extra stiffness of the contoured insole might have an additional effect on minimizing MTP dorsiflexion leading to larger pain reductions compared with rocker shoes with flat insoles. Contoured sandals also seem to have a positive effect on pain related to plantar fasciitis. However, evidence about shoe adaptations is limited, and more research is needed to evaluate the effects of shoe sole design on plantar fasciitis.

Although rocker shoes aim to relieve pain symptoms and promote healing processes by reducing plantar fascia strain during gait, the purpose of AFOs is to increase tension on the plantar fascia during rest. During sleep, the plantar fascia is in a shortened and nonfunctional state.[47] Through slight dorsiflexion at the ankle joint with an AFO, the plantar fascia remains in a lengthened state, and weight-bearing in the morning can better be tolerated by the

patient.[73] In addition, slight tension of the plantar fascia during sleep is hypothesized to promote plantar fascia healing.[47] Although the evaluated AFOs differ in design (posterior vs anterior) and time of wearing (day vs night), all had a positive effect on pain and function. Anterior night splints were found to be more comfortable and more effective in pain reduction than posterior night splints, but evidence is weak, as only one study included both types of night splints.[32] The investigated anterior AFO maintained the ankle angle at 90°, whereas the posterior AFO positioned the ankle in slight dorsiflexion. More ankle dorsiflexion increases tension on the plantar fascia through the pulling force of the Achilles tendon, possibly leading to more discomfort for the patient. AFOs seem to be as effective as insoles or stretching, but combining night splints and insoles led to enhanced improvements in pain and function compared with wearing night splints or insoles alone.

The previously mentioned treatment options were mostly prescribed for a longer period of time (>1 mo). Taping is mainly used in the short term (<1 mo) to improve biomechanics of the foot.[52,64,73] Several taping techniques were used in the included studies, but all resulted in improvements in pain and function. It is unclear whether tape or insoles are more effective in reducing plantar fascia complaints. Abd El Salam and Abd Elhafz[53] favored insoles over tape, whereas Lynch et al[26] reported the opposite and favored tape over insoles and Van Lunen et al[60] did not find significant differences between both interventions. Several reasons might be responsible for these contradictory findings. In the study of Lynch et al,[26] participants received tape in the first 4 weeks of treatment and then used an insole. However, the contribution of each of the interventions to the reported decrease in pain is unclear. Van Lunen et al[60] measured participants once, whereas the others had multiple follow-up sessions ranging over a few weeks.[26,53] Van Lunen et al[60] found significantly lowered rearfoot mean peak pressure in patients receiving tape but no significant difference in pain scores between tape and insoles. A lowered mean peak pressure might be beneficial in treating plantar fasciitis but maybe only in the long term. If so, it is not surprising that no significant differences in pain scores were visible during that single measurement.

Methodological differences such as outcome measures, follow-up time, and treatment design limit comparability between studies. Therefore, we could not conclude which treatment is most effective in relieving symptoms associated with plantar fasciitis. In addition, risk of bias was moderate to high in all included studies requiring cautious interpretation of the obtained results. Largest contributors to a high risk of bias were lack of blinding, unclear allocation concealment, and use of cointerventions. Especially, the use of cointerventions limits interpretability of the current study outcomes. For example, insoles have a beneficial effect on pain and function and their use as cointervention most likely affects overall treatment outcomes. In addition, the application of cointerventions was inconsistent and poorly reported. In some studies, additional treatment was provided to all participants, some only to a part and others did not explicitly say whether they allowed additional treatment or not. Future studies should avoid cointerventions or investigate their interaction with the primary intervention to improve interpretability of treatment outcomes.

Furthermore, we want to note that less than half of all studies used objective measures such as foot pressure to evaluate mechanical treatment effects. Mechanical treatments aim to modify biomechanical characteristics of the foot such as plantar pressure distribution in insoles or plantar fascia length in rocker shoes and AFOs. To judge the effectiveness of these mechanical treatments, their biomechanical effects should be evaluated in addition to measures of pain and foot function. For example, musculoskeletal models could be used to establish the effect of rocker shoes on plantar fascia strain during gait in patients with plantar fasciitis.[72] Information on the biomechanical treatment effects can, in turn, be used to understand and improve the effectiveness of mechanical treatments.

Conclusions

Mechanical treatment seems to be beneficial in relieving symptoms related to plantar fasciitis. Methodological limitations of current studies do not allow to conclude whether any of the investigated treatments is more effective in relieving pain or improving foot function in patients with plantar fasciitis. Combining different treatment modalities such as AFOs and insoles or rocker shoes and insoles seems to enhance clinically relevant treatment effects. Future studies should aim to improve methodological quality using blinding, allocation concealment, avoid cointerventions, and use biomechanical measures of treatment effects.

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Appendix: Exact Search Terms

MEDLINE	Embase	CINAHL, I	Cochrane
1. “fasciitis, plantar” [MeSH Terms] OR “heel spur”[MeSH Terms]	1. ’plantar fasciitis’/exp OR ’heel spur’/exp	1. (MH “Plantar Fasciitis”) OR (MH “Heel Spur”)	1. MeSH descriptor: [Heel Spur] explode all trees or MeSH descriptor: [Fasciitis, Plantar] explode all trees
2. “plantar fasciitis“ [Title/Abstract] OR “plantar fascitis“ [Title/Abstract] OR “plantar fasciosis“ [Title/Abstract] OR “plantar fasciopathy“ [Title/Abstract] OR “calcaneal spur*“ [Title/Abstract] OR “heel spur*“ [Title/Abstract] OR “heel pain“ [Title/Abstract] OR “plantar pain“ [Title/Abstract]	2. ’plantar fasciitis’:ti,ab OR ’plantar fascitis’:ti,ab OR ’plantar fasciosis’:ti,ab OR ’plantar fasciopathy’:ti,ab OR ’calcaneal spur*’:ti,ab OR ’heel spur*’:ti,ab OR ’heel pain’:ti,ab OR ’plantar pain’	2. TI (“plantar fasciitis” OR “plantar fascitis” OR “plantar fasciosis” OR “plantar fasciopathy” OR “calcaneal spur*” OR “heel spur*” OR “heel pain” OR “plantar pain”) OR AB (“plantar fasciitis” OR “plantar fascitis” OR “plantar fasciosis” OR “plantar fasciopathy” OR “calcaneal spur*” OR “heel spur*” OR “heel pain” OR “plantar pain”)	2. “plantar fasciitis” or “plantar fascitis” or “plantar fasciosis” or “plantar fasciopathy” or “calcaneal spur*” or “heel spur*” or “heel pain” or “plantar pain”
3. #1 OR #2	3. #1 OR #2	3. #1 OR #2	3. #1 or #2
4. “orthotic devices”[MeSH Terms] OR “shoes”[MeSH Terms] OR “splints”[MeSH Terms]	4. ’orthosis’/exp OR ’shoe’/exp OR ’splint’/exp	4. (MH “Orthoses+”) OR (MH “Orthopedic Footwear”) OR (MH “Shoes+”) OR (MH “Splints”)	4. MeSH descriptor: [Orthotic Devices] explode all trees or MeSH descriptor: [Shoes] explode all trees or MeSH descriptor: [Splints] explode all trees
5. afo*[Title/Abstract] OR “arch support*“ [Title/Abstract] OR footwear[Title/Abstract] OR “heel cup*“ [Title/Abstract] OR “heel pad*“ [Title/Abstract] OR inlay*[Title/Abstract] OR insert*[Title/Abstract] OR insole*[Title/Abstract] OR orthos*[Title/Abstract] OR orthot*[Title/Abstract] OR rocker*[Title/Abstract] OR shoe*[Title/Abstract] OR splint*[Title/Abstract] OR sole*[Title/Abstract] OR strap*[Title/Abstract] OR tape[Title/Abstract] OR taping[Title/Abstract]	5. afo*:ti,ab OR ’arch support*’:ti,ab OR footwear:ti,ab OR ’heel cup*’:ti,ab OR ’heel pad*’:ti,ab OR inlay*:ti,ab OR insert:ti,ab OR insole*:ti,ab OR orthos*:ti,ab OR orthot*:ti,ab OR rocker*:ti,ab OR shoe*:ti,ab OR splint*:ti,ab OR sole*:ti,ab OR strap*:ti,ab OR tape:ti,ab OR taping:ti,ab	5. TI (afo* OR “arch support*” OR footwear OR “heel cup*” OR “heel pad*” OR inlay* OR insert* OR insole* OR orthos* OR orthot* OR rocker* OR shoe* OR splint* OR sole* OR strap* OR tape OR taping) OR AB(afo* OR “arch support*” OR footwear OR “heel cup*” OR “heel pad*” OR inlay* OR insert* OR insole* OR orthos* OR orthot* OR rocker* OR shoe* OR splint* OR sole* OR strap* OR tape OR taping)	5. afo* or “arch support” or “heel cup*” or “heel pad*” or footwear or inlay* or insert* or insole* or orthos* or orthot* or rocker* or shoe* or splint* or sole* or strap* or tape or taping
6. #4 OR #5	6. #4 OR #5	6. #4 OR #5	6. #4 or #5
7. #3 AND #6	7. #3 AND #6	7. #3 AND #6	7. #3 and #6